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MAINTENANCE AND REPAIR IN SMALL SCALE INDUSTRIES

by

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1. ROLE AND IMPORTANT OF SMALL SCALE INDUSTRIES IN THE ECONOMY OF DEVELOPING COUNTRIES.

1.1 GROWTH AND RESULTS ACHIEVED SO FAR

The significant contribution the small scale sector can make to the process of social transformation in developing countries is well illustrated by the role played by this sector in the Indian economy. Small scale industries contribute about 30% of the country's total production and account for about 32% of the total employment. Besides contributing as ancilliary units, small industries have contributed a lot in making a variety of items of consumption, including quite a few sophisticated ones. The success of this concept is further borne out by the rapid rate at which the Japanese economy, based mainly on small scale sector and in particular on the subcontracting system, has progressed in a short span of about 25 years. The major advantages offered by small scale industries which are particularly relevant to developing countries are outlined below :

a. Immediate and large scale employment opportunities at relatively small capital cost;

b. More equitable distribution of national income;

c. Effective mobilization of capital and skill which might otherwise remain unutilized both in rural and urban areas;

d. Integration of rural economy based mainly on the small sector with large scale industries;

e. Avoidance of some problems connected with unplanned urbanization.

It will now be pertinent to look back at the results achieved by some of the developing countries say India, who have, in the past, made conscious and planned efforts for the growth

of small scale sector. The results though difficult to quantify, have been quite encouraging. There could be no better way to illustrate this point than to give the percentage share of small factories, as at present, in certain significant areas of industrial development.

Industries	Percentage share of small factories in the aggregate value added
Knitting mills	94
Grain mill products	86
Weaving apparel	82
Tanneries and leather finishing plants	80
Photographic and optical goods	68
Canning and preservation of fish and other	62
Light engineering goods like electric irons, wire, matting, rolling shutters, shoe tacks, barbed wire, machine screws, spectacle frames, pressure cookers, steel furniture etc.	50
Canning of fruits and vegetables	43
Glass and glass products	39
Cardage ropes and twine industries	38
Manufacture of foot wear	30
Professional and scientific measuring and controlling instruments	29
Clocks and watches	23
Manufacture of bicycles, parts and connected items.	19
Paints, varnishes, lacquers and misc.products	18

Besides items like clinical thermometers, paper pins, gem clips, measuring cotton tapes, mechanical toys, glass ampules, plaster board, pencil sharpeners, hair clippers, chalk, buttons, garment

buckles and many other similar items are being manufactured entirely in the small scale sector.

The above data should provide indicators to the developing nations in allocating priorities for growth of the various sectors of small scale industrial development.

Apart from the quantitative growth outlined above, there has been significant increase in the variety of items improvement in quality and design of products. A large number of items being manufactured by the small scale sector are in conformity with the specified Government requirements or with the well laid out specifications, some of them matching international standards of quality. The exports of certain items particularly of handlooms, handicrafts, coir and silk are mounting. In addition, the various products, including a large number of sophisticated engineering items, exported from the country include components made by small sector units.

The sector which was thus mainly confined to conventional industries in household units originally has emerged as a modern sector of economy with machines and power turning out quite a few sophisticated engineering and consumer goods besides a large variety of other items.

2 SOME PROBLEMS AND HANDICAPS OF SMALL SCALE UNITS

The growth of small scale sector so far achieved in India, as mentioned above, has not been without problems and handicaps. Some of these have already been overcome while others are being tackled. However, with active and ever increasing support from the Government, the sector is continuing to make progress. The major problems being faced by the sector are -

2.1 Paucity of Funds

Lack of sufficient financial resources has been and continues

to be a major source of problem for many small scale units. However, the Government has of late done a lot towards providing sufficient credit facilities to the existing as well as the new small entrepreneurs. Recent nationalization of major banks should be a helpful step in this direction.

1.2.2 Need for Modernization

The costly machines and equipment in most small scale units are in unsatisfactory condition because -

a. There is no system of plant maintenance;

b. There is no conscious replacement policy.

The basic attitude is to get the most out of a machine, sometimes even at the cost of quality.

The same reasoning applies to processes employed for manufacture, with very little or no Research and Development effort being put in for their improvement. This is particularly significant for industries with fast changing product design and specifications. All this leads to obsolescence of both machines and processes eventually involving much higher cost.

1.2.3 Insufficient Quality Control and Testing Facilities

The significance of quality as a necessary cost item has not yet been fully realized by most small scale industries. This aspect is now occupying increasing attention with growing competition in domestic as well as export markets.

1.2.4 Marketing

Insufficient or no Market Research to establish the demand for the product has led many small scale units into serious problems. Lack of sales promotion methods is another problem particularly when the competition begins to be felt.

1.2.5 Availability of Raw Materials

Availability of raw materials, particularly the scarce and imported items, has been an area of major problems for this sector. Government is now taking some active steps in solving this problem.

1.2.6 Inadequate Planning for Future

Most small industrialists mainly because of their generally conservative background are satisfied with their past growth and the present performance. Their planning for future is either non-existant or at best nominal. The weakness on this count has in fact been the cause of failure of many small scale units.

1.2.7 Lack of Professional Management Attitudes

Majority of problems including the ones mentioned above arise out of overconfidence of the small scale entrepreneurs about their ability to tackle everything themselves. This is far from being true in most situations. Dependence on outside Government and private agencies for help on specific problems requiring specialized knowledge and advice is therefore a necessity for survival rather than being a luxury as it is commonly believed. In fact, all this can be summed up as lack of professional management attitudes which are a must for successful running of any business, large or small. These attitudes are not necessarily acquired through specialized and formal professional management education and training alone, but can be developed even on the job by an open minded approach to problems, and far sightedness. It is also not uncommon to come across small industrialists who, out of their sheer anxiety to appear modern employ highly qualified staff but are most reluctant to take their specialized advice even when the situation

demands it.

1.2.8 Relationship with large scale sector

Adequate integration between the large and small scale sector has not yet taken place as both sectors are not fully reconciled to the need for their coexistence in the economy of a developing nation. In this connection, the developing countries should draw on the experience of many developed and advanced nations where small scale sector continues to play vital role even today. Most of the problems and weaknesses of small scale units as outlined above have direct bearing on their productivity and therefore the profits. In fact a large number of such units work on flimsy foundations leading to their getting pushed backwards everytime there is a shake up of the economic structure in the country on account of either internal or external influences. Such a situation was actually witnessed in India in 1962 and again in 1965 when a large proportion of such units had to face very difficult times and some were almost forced to close their doors, inspite of considerable support available to this sector from the Central and the State Governments. These type of failures, besides hitting hard the comparatively weak section of society, discourage new entrepreneurs thus contributing to stagnation of economy, unemployment, labour unrest and many other consequentional problems particularly undesirable for the developing countries.

However, inspite of the handicaps and the problems mentioned above, the small scale sector, continues to grow. A conscious policy of encouragement on the part of the Government has given great impetus to its development. It is estimated that small and medium scale industry in India has over 500 million U.S.dollars

worth of machinery and equipment installed in the plants. All this capital equipment is extremely precious from the point of view of a developing country with scarce financial resources. Besides most of this investmen is from savings of the hard earned money of people with small means. It is therefore not easy for the country and for the small entrepreneurs in particular to find resources for new investments.

In this context the repair and maintenance of machines in the small scale sector obviously assumes great significance. It is therefore only appropriate that UNIDO should focus attention of administrators, promoters and above all of the small entrepreneurs, on this important subject, with particular reference to the developing countries.

2. PROBLEMS OF REPAIRS AND MAINTENANCE IN SMALL SCALE UNITS AND THE ROLE OF VARIOUS GOVERNMENT AGENCIES

Before the problems of repair and maintenance in small scale units are discussed it is desirable to define what exactly is meant by maintenance and the increasing importance of it, particularly because of the changing designs of machines and equipment.

2.1 OBJECTIVES OF MAINTENANCE FUNCTION

What is maintenance function? What all is it supposed to do? The all too customary answer will be: to maintain and repair plant assets. This is not strictly true. We are used to dealing with maintenance people, if there are any in existence specifically for the purpose, only when the machines breakdown and we are interested in getting them back into operation soonest possible. Accountants often refer to maintenance costs as 'burden'. To them maintenance people are non-productive second class employees who depend upon production people for existence. If the maintenance function is built around such a limited concept, its appreciation and organization is bound to be limited and of course ineffective. We have to look to the objectives of the whole Company to get a realistic objective for maintenance. If we do this, we will find that maintenance has the same aim as all other functions in the business. It is an inseparable part of the overall organization.

When we think of maintenance as a means of making profit for the Company our concept is on a firm foundation. We then realize it is quite normal for machines to breakdown without proper maintenance. Maintenance should therefore be organized to cope with this normal situation and not as a contingency needed only when everything goes wrong. Maintenance is therefore much more than just a service to production. It is a means to profit by

keeping the plant and equipment productive and competitive. The objectives of maintenance function can therefore be spelled out as -

a. Carry out repairs and altrations to plant, equipment, buildings, in fact to all assets, at minimum cost and maximum benefit to the company;

b. Anticipate need for repairs and altrations;

c. Avoid breakdowns and slow down of equipment.

d. Train people in the skills of directing and doing the job;

e. Have enough materials and supplies on hand to keep plant and equipment productive at lowest cost.

2.2 REASONS FOR INCREASING IMPORTANCE OF MAINTENANCE FUNCTION

Until the forties most machines and equipment were of slow speed, sturdily built, older design with hardly any sophisticated controls. In developing countries like India such machines were initially installed by the Foreign Company's Commission Engineers and the operation and maintenance staff were trained on the equipment itself. In case of breakdown the equipment would be stopped for carrying out the necessary repairs. There was no pressure on capacities. Repair and maintenance element as a percentage of the total cost was comparatively too low to be bothered about in any case.

With growth of industrialization in the advanced nations as also in the developing countries the picture has changed quite fast. The equipment and machines imported into the developing countries these days are designed to work at much higher speeds, have more precise design, lesser safety factor, greater mechanization and sophisticated electric, electronic and hydraulic controls. If these machines are operated in the same old way the breakdowns would

occur much sooner and would last much longer. This would result in -

a. locking up of scarce capital resources which is the most important factor inhibiting rapid growth of industrialization in the developing countries;

b. hold up of production. The effect of this can be very marked particularly in a continuous flow type of operation;

c. Increase in consumption of spares;

d. Increased requirement of maintenance personnel.

The only way to keep maintenance costs under control, is therefore to make all out efforts for better maintenance of equipment and thereby reduce machine failures and plant stoppages. The exact impact of better maintenance in terms of reduced costs will depend on the type of equipment employed by various industries but with increasingly competitive economies, even in the developing countries, the total maintenance costs are certainly beginning to be felt as significant.

These objectives remain the same whether we are thinking of maintenance in a large scale Company in an advanced country or of a small scale unit, in a developing country. The difference may however be in the way the function is organized. While in large scale industries with sophisticated management controls maintenance may be the responsibility of a separate professional manager, provided with an elaborate set of staff, equipment and tools and reporting to the Works Manager, in a growing small scale unit, it may be looked after by the Manager of the unit or in some cases by the owner himself, with the assistance of a foreman and/or a few skilled fitters. However, it is important to note that to get effective service from the main-tenance

function it is extremely desirable that its responsibility does not rest with a person directly incharge of production.

2.3 SPECIFIC PROBLEMS OF MAINTENANCE IN SMALL SCALE UNITS

We shall now attempt to outline the specific problems of repairs and maintenance in small scale industries, in the developing countries.

2.3.1 Lack of Management Appreciation

Maintenance in developing countries for most people means repairs when a machine or equipment breaks down. Even in the oldest organized industry in India, i.e. textiles it is not uncommon to come across factories with very poor appreciation of the maintenance function leading to a large percentage of machines remaining out of production for long durations.

Let us try and understand why such an important aspect of production is neglected, particularly so in the small scale sector. It is mainly because the effect of this neglect on profitability of the operation is not at all realized. In an economy like that of India, and this should be true of most developing countries, where one can sell whatever one makes, the question of making a product efficiently does not often occur to the producer. To a businessman, the primary object of all manufacturing activities is to make profit and there is no reason why it should not be so. Therefore as long as profits are being made hardly any thought is given to areas like maintenance where the short term gains appear to be insignificant. When conditions change, and the loss is in sight, and this is a continuous phenomena in developing countries, the business managers/owners sit down to think about the methods to turn losses into profits. Even in this thought process, it does not

normally occur to the manufacturer that along with the capital and the labour productivities, machine productivity also plays an important role in reducing the cost of production. On the contrary, plans are made to run the machines for 24 hours. The men and the machines are overworked to produce more with a view to reduce costs. It is not realized that along with increase in production, the cost is also being increased, as both men and machines get fatigued if overworked leading to breakdowns and hence more maintenance and attention.

Besides appreciation of the fact that good maintenance will ultimately contribute to better profits, it is important that small scale unit owners/managers are trained to have sufficient knowhow of the modern methods employed for repairs and maintenance. In this context, it will be useful to describe sequentially the various changes in concepts and methods which have taken place with the passage of time. The oldest form of maintenance was 'capital replacement', i.e. the tool/equipment was replaced by a new one as soon as the old broke down. With increasing sophistication of machines, the above method became very costly and was therefore replaced by what is commonly called 'breakdown maintenance' which implies repairing the machine whenever a breakdown does occur. This type of repair almost meant'everybody running in all directions' to get the necessary spares, components and the services of a fitter to put the machine back into commission as early as possible. This is the stage at which almost all small scale industries are.

The time taken and the additional cost involved in 'breakdown maintenance' led to more systematic planning of maintenance

work and further development of a new system called 'scheduled maintenance' which means carrying out most of the repairs at scheduled intervals. There is no evidence of this yet in small scale industries in the developing countries. The latest development in the field is that of 'Preventive maintenance' the concept which implies carrying out the repair and maintenance at predetermined intervals so as to avoid breakdowns. The practice of this, in small scale industries is non-existant. Even the industrialists who know about the existance of this concept find it hard to be convinced that the costs involved in setting up a well planned preventive maintenance programme can be easily justified in terms of its return of lesser down time on machines.

2.3.2. Lack of maintenance machining facilities

A lot of problems connected with maintenance of machines in small scale units stem from inadequate availability of maintenance machining facilities. A small entrepreneurs will do his best to tap all his resources of finance and otherwise for purchase of additional production machinery but when it comes to spending money on the most necessary maintenance equipment, tools, gauges and instruments, his attitude will at best be lukewarm. Machines are generally run to death because their stoppage for carrying out repairs and maintenance is considered waste of time. In view of the shortage of foreign exchange in the developing countries, this attitude is not only antiproductivity but also antisocial and unpatriotic. Most small scale industries have therefore hardly any maintenance machining facilities. When breakdowns requiring machining of new or the parts in use, do occur, either the

standard machine tools used for production, if there are any, are stopped for carrying out the maintenance job, or a research is started for locating an outside source for help. The process therefore either leads to loss of precious production or a lot of waste of time because the outside facilities, even if available, cannot generally be quick. This is particularly true of maintenance jobs requiring accuracy and precision where an outside agency cannot be expected to have any idea of the functional importance of the tolerences etc. required for the one off job.

2.3.3 Inadequate availability of skilled personnel

One of the commonest problems in the developing countries is the inadequate availability of well trained and experienced managers, supervisors and above all the tradesmen required particularly for repair and maintenance jobs. Inspite of substantial efforts made by the Government in developing countries like India, for setting up a large net work of training institutes for the purpose, the problem continues as the pace of growth of small industries in most cases is faster than the availability of trained personnel.

One of the important facts connected with training of skilled personnel for maintenance jobs, is the specialized need of every industry. Even when the basic education and training are there, the specific skills required by each industry can be developed by experience alone. This is therefore a slow process. A comparatively larger turnover of maintenance personnel because of increasing employment opportunities, further adds to this problem.

2.3.4 Problem of Spare parts

Maintenance of machines besides requiring management appreciation of the need and proper tuning, the machining facilities and the skilled personnel, need spare parts. Unlike in advanced countries where important spares can be obtained in a matter of days or sometimes in hours, the small scale industries in the developing countries are greatly handicapped particularly for the imported spares, because of the extremely lengthy procedures involved in getting the licences to import the most crucial spare parts. It may take anywhere from 12 to 18 months between recognition of the need to have a part and to get it in the factory. This therefore necessitates -

a. advance planning of spare part requirements which by no means is an easy task for the small industrialists;

b. locking up precious money in inventories or running the risk of loss of production.

Both ways it is a complicated and a costly exercise.

2.3.5 Attitudes of workmen to maintenance

It is quite common to come across instances of production personnel washing their hands and standing aside the moment a machine breaks down. Even where separate maintenance personnel are in existance, this attitude is undesirable. The problem mainly arises from the fact that the operators do not take sufficient pride in cleaning and lubricating the equipment. This is normally left to helpers who have no knowledge of the importance of such jobs.

Lack of sufficient attention to housekeeping is another contributory factor for poor maintenance. The tools are normally kept in haphazard places with no regard to their upkeep. The

The surroundings are usually untidy with the result precious time is lost for searching the tools and instruments required for maintenance and even when these are located, a few are found to be in usable condition.

2.3.6 Training in maintenance practices.

Even if all the facilities required for proper maintenance of plant and equipment are available, a lot depends on how well and properly these are utilized. Attention to details like the working environments, tools storage and upkeep, precision-mindedness and other similar attributes can be attained by proper training and experience alone. It is this area of using the correct maintenance practices that small scale industries have to learn a lot from their larger counter parts. Suitable Government agencies can also help in speeding up this process of learning, by imparting specialised training in class room as also for tackling specific problems on the spot.

2.3.7 Poor and inadequate factory space

Industrial Estates/Areas/Flatted factory space are a partial answer to the problem of small units who cannot afford to move to ready built factories. Properly constructed and laid out factories are essential for guarding the expensive machines against dust, rain, water, smoke and other injurious fumes from the surroundings.

2.4 IMPLEMENTATION AND ROLE OF GOVERNMENT EXTENSION SERVICE AGENCIES

Because of the problems of small units mentioned so far special policies, programmes and measures have been and are being arranged by several developing and even developed countries, for assisting

the growth of small industrial units, through establishment and operation of various extension service agencies, financial institutions and other corporations and bodies like productivity councils. It will therefore be desirable to have a brief look at the functions of these agencies. The working of these organizations in India, has been taken as an example because the author is familiar with their operation. Besides it is generally recognized that India has the biggest and perhaps the oldest of an all embracing organization in the world, called Small Industries Development Organization, run by the Government of India, in addition to the other steps the Centre and the State Government agencies are taking for development of small industries. The functions of these agencies are -

2.4.1 Small Industries Service Institutes

The basic functions of the Small Industries Service Institutes are :

(i) To advise small units on improved technical processes and use of modern machinery and equipment.

(ii) To prepare designs and drawings for machines and machine parts, equipment, dies, jigs, tools and fixtures.

(iii) To demonstrate the use of modern technical processes through workshops in extension centres and also small mobile workshops mounted on trucks.

(iv) To render technical assistance to small units on the use of raw materials, improved design of machinery etc.

(v) To carry out research on questions like proper use of raw materials, improved designs of machinery etc.

(vi) To conduct training classes in such subjects as blue-print

reading, heat-treatment and foundry for the benefit of small industrialists and artisans.

(vii) Technical assistance in the development of ancillary units.

(viii) To extend knowledge of the latest tools and techniques of management, particularly in the fields of Production Planning and Control, Financial Accounts, Cost analysis, Marketing and Advertising.

(ix) To undertake distribution and surveys with a view to assisting small manufacturers in determining major distribution centres for their products, establishing contacts with important wholesale and retail dealers and obtaining dealers' and consumers' reactions to price, quality and design of products.

(x) To act as an Information Centre, including the publication of bulletins, pamphlets, model schemes and answering of enquiries for economic and commercial information.

(xi) To conduct economic surveys in particular industries and areas and make concerete recommendations for a development programme.

2.4.2 <u>The National Small Industries Corporation (NSIC)</u>

The main functions of the National Small Industries Corporation established on 1955 are the following :

(i) Supply of machinery to small units on hire purchase basis. The object of this scheme is to render assistance to small units for purchase of machines and plant and repayment of the amount in easy instalments. Request for supply of machines on hire purchase basis has to be made in the prescribed application form obtainable from the offices of the NSIC, the offices of the Directors

of Industries and Small Industries Service Institutes. All applications are to be forwarded through the State Directorates of Industries. Only such applications as are recommended by the Directorate of Industries are considered taking into account the industry involved the raw material required and the foreign exchange required for importing the machines. Certain industries where sufficient capacity already exists are not encouraged by the Corporation. On acceptance of the application by the Corporation and subsequently when offers are made to the small units for the machines accepted for supply, and earnest money of 20% of the value of machines (30% in case of industrial furnaces) is required to be paid in one instalment before the placement of order. The percentages are worked out on the basis of f.o.r. cost for indigenous machines and applicants' landed cost (duty & clearing charges) for the imported machines. The applicants are also required to pay a service charge in instalments based on the value of the machines supplied. The interest charged is normally 6%. Applicants are required to obtain quotations as far as possible from manufacturers or their agents for the machines asked for and valid quotations are to be enclosed alongwith the application.

(ii) Assistance to small units in securing contracts from the Central Government Stores Purchase Agencies for supply of stores.

(iii) Distribution of radio and transistor valves manufactured by M/s.Bharat Electronics Ltd. to small scale radio

manufacturers.

(iv) Management of Proto-type Production and Training Centres at Delhi, Rajkot and Howrah. These are important centres of training tradesmen required both for small and large industries.

2.4.3 State Government Agencies

The primary responsibility for the development of small scale industries is that of the Director of Industries of the respective State. The main functions of the State Directorates of Industries are as follows :

(i) All enquiries relating to the establishment of new small scale units, their location and requests for assistance towards the same.

(ii) Financial assistance to small scale units under the State Aid to Industries Act.

The terms on which loans are granted to small scale units under the State Aid To Industries Act have been progressively liberalized. Loans up to Rs 1000/- are being advanced by most State Governments on personal bonds, upto Rs 5000/- against two personal sureties and above Rs 5000/- at 75% of the security offered, which includes land, building, machinery, equipment, stocks and other assets, etc. including, those created out of the loan. These loans are repayable in easy instalments, spread over 10 years. The rates of interest charged varies from State to State. In many States, powers have been delegated to District Industries Officers or District Magistrates for distributing loans up to Rs 2000/-. To help industrial cooperative societies for building up their resources 75% of the share capital

is offered by the Central Government as a two-year loan, the balance to be obtained from the State Governments and/or the party concerned.

(iii) Allocation of controlled raw materials, such as steel copper and other non-ferrous metals, whether indigenous or imported, to small scale industrial units.

(iv) Supply of electric power, transport facilities.

(v) Requirements of land.

(vi) Development of Industrial Estates.

(vii) Grants of essentiality certificates for import licences, raw materials, components etc.

(viii) Training facilities.

(ix) Organization of cooperatives and other forms of assistance.

2.4.4 State Small Industries Corporations

In fifteen states 'Small Industries Corporations' have since been set up. Though emphasis laid on the various functions entrusted to these Corporations differ from state to state, by and large their functions are as under :

(i) Supply of raw materials to small scale industrial units.

(ii) Supply of machinery on Hire Purchase basis.

(iii) Running of Common Facility Service Centres.

(iv) Running of Production Centres.

(v) Providing marketing assistance.

(vi) Providing built-up factory accommodation for small scale units by setting up and managing industrial estates.

2.4.5 National Productivity Council (NPC)

The National Productivity Council is an autonomous organisation registered as a Society. Representatives of Government employees,

workers and various other interests participate in its working. Established in 1958, the Council conducts its activities in collaboration with institutions and organisations interested in the Productivity Drive. Forty-six Local Productivity Councils have been established all over the country and they work as the spearhead of the productivity movement.

The purpose of NPC is to stimulate productivity consciousness in the country and to provide services with a view to maximising the utilization of available resources of men, machines, materials and power; to wage war against waste, to help secure for the people of the country a better and higher standard of living. To this end, NPC collects and disseminates information about techniques and procedures of productivity. In collaboration with local Productivity Councils and various institutions and organizations it organises and conducts training programmes for various levels of management in the subject of productivity. It has also organised an Advisory Service for Industries to facilitate the introduction of productivity techniques.

Recognising that for a more intensive productivity effort, the training and other activities of NPC designed to acquaint management with productivity techniques, should be supported by demonstration of their validity and value in application, NPC has decided to offer a productivity survey and implementation service)PSIS) to industry. This service is intended to assist industry adopt techniques of both management and operational efficiency consistent with the economic and the social aspirations of the community. PSIS is concerned with the investigation of management and operational practices and problems, measures of improvement and their implementation. NPC has also established at Bombay a special Fuel

Efficiency Service.

NPC publications include pamphlets, leaflets and Reports of Productivity Teams. NPC utilises audio-visual media of films, radio and exhibitions for propagating the concept and techniques of productivity. Through these media NPC seeks to carry the message of productivity and to create the appropriate climate for increasing national productivity.

NPC has done quite a lot work on conducting courses and seminars for improving management appreciation of the maintenance function.

2.4.6 Help From Financial Institutions

Besides the machinery provided by the NSIC on hire purchase basis, the following institutions render financial assistance to small scale industries :

a. State Bank of India Scheme

In order to evolve a procedure for coordinating the activities of the various credit agencies, the State Bank of India has started a scheme for assistance to small scale industries. Under the scheme an applicant for credit, instead of having to approach a number of agencies, has only to go to one local agency, whether it be a branch of the State Bank or a cooperative credit institution. The local agency will receive and deal with applications for all types of loans. It will either itself dispose of the application or will forward it to the appropriate agency. Steps have also been taken to streamline the State Bank's procedure, so that it is now possible for the Bank to extend at all branches credit facilities to small scale industries, against pledge of raw materials and or semi-finished goods either on lock and key or factory-type basis. It is also proposed, in appropriate cases, to offer

clean type accommodation backed by the guarantee of another suitable person.

b. Reserve Bank of India Scheme

This scheme formulated by the Government of India for guaranteeing loans granted to small scale industries by Banks and other financial institutions, was implemented in 1960. The main object of the scheme, is to enlarge the supply of institutional credit to small scale industrial units by ensuring a degree of protection to the lending institutions against possible losses in respect of their advances. The scheme provides for the sharing of such losses between the lending institutions and the Government of India. To begin with the scheme was made operative in 22 districts selected on the basis of the relative importance of outstanding loans to small scale industrial units and the potentialities for further expansion of such loans. The scheme has now been extended to cover the entire country. The scheme provides guarantee to advance by 83 selected credit institutions comprising 49 scheduled Banks, 21 State Cooperative Banks, 14 State Financial Corporations and the Madras Industrial Investment Corporation besides the State Bank of India and its seven subsidiaries. The maximum amount recoverable against the guarantee issued under the scheme in respect of any advance will be Rs 1 lakh.

c. State Financial Corporation

The State Financial Corporation also advance medium and long term loans to small scale industries, out of their own funds. Generally, the Corporations advance loans between Rs 25,000/- and Rs 1,00,000. The rate of interest charged is normally 7%

per annum, subject to rebate of % 1/2% per annum for prompt return of money.

All these agencies have so far been of tremendous help in tackling and/or providing the necessary services to tackle the repair and maintenance problems of small scale units. However, a lot more can be done to improve quality of the services rendered by them.

3. FACILITIES REQUIRED FOR REPAIR AND MAINTENANCE FOR SMALL INDUSTRIES

Before the facilities needed for repair and maintenance, under different conditions are discussed, it is desirable to describe special characteristics of requirements for the small scale units.

3.1 SPECIAL CHARACTERISTICS OF SMALL SCALE UNITS

3.1.1 Rural Areas

In discussing this topic the case of India is taken since the rural economy of a large number of developing countries is based on agriculture, as in India. Besides small scale industries have made considerable progress in this country.

India is mainly an agricultural country as 75% of its population still lives in villages and is connected with agricultural production in some way or the other. The whole economy of the country is in fact closely linked with food production. With increasing realization of this and with all the Government's encouragement and cooperation, the methods of food production and hence the ways of working of the small scale sector which is mainly agriculture based, are fast undergoing changes. Bullocks and wooden ploughs are being replaced by tractors and implements. In some places even mechanical thrashers and winnowers are being used. The dependence on monsoons is increasingly being replaced by modern irrigation facilities. Water dams in almost all parts of the country combined with many other electric power generation schemes are beginning to provide the necessary light and power to the remotest villages. Irrigation by pump and motor sets is the order of the day even in small farms where electric power is available and diesel engines are commonly in use where electricity has yet to reach.

All this change has been made possible because of a conscious Governmental policy of encouraging mechanized farming. This is

evident from the fact that in the initial stages, the Government advanced a large number of loans to farmers for purchase of tractors and implements and the effect of this on the farm productivity has been heartening. However, lack of adequate maintenance facilities has led to a large number of costly equipment remaining under utilized. For the farmer in the out of the way village, it is by no means an easy task to organize for the maintenance of his tractor, implements and the pump etc, whenever any of these do breakdown. The nearest workshop which itself is poorly organized and has the scantiest facilities is perhaps miles and miles away with no quick and economical means of transportation and communication available. With growth of mechanized farming, the repair and maintenance work, which used used to be the domain of the village mistri (technician skilled by experience alone), the blacksmith and the carpentar is changing its character. With ever increasing number of tractors, implements, pumps, motors and the like, the need for better maintenance facilities is beginning to be felt.

The increasing affluence of the village farmers and the conventional repairman has led to the evolution of a new class of entrepreneurs, i.e. the once skilled mistri becoming the owner of a small workshop having a lathe or two in addition to few other machines. A large number of such workshops have sprung up in areas where the skills were concentrated, e.g. Ludhiana in Northern India which was once famous for its artisans has become a sizeable Industrial centre with numerous small factories manufacturing sewing machines, bicycle and even machine tools, besides many other consumption and other items. Many of the smaller workshops working as ancilliaries to the comparatively bigger manufacturing units are also a source of providing the

necessary maintenance facilities for the farm assets like tractors, implements etc.

The need for proper and planned repair and maintenance in the rural sector, both for farm equipment and otherwise is however hardly recognized. The farmer owning a tractor is not conscious of it because of his lack of education and experience on the proper use of mechanical means of agriculture. The small village workshop owner is equally ignorant when it comes to maintenance of his own machines, for similar reasons. All the advantages of increased machine productivity by better maintenance have yet to be brought home to them. The process has already begun, perhaps as a result of a son or a relative of the farmer or the workshop owner, having obtained formal trade training in the nearest Industrial Training Institute. A lot however, remains to be done in improving the maintenance facilities for tractors, implements and the like.

3.1.2 Urban Areas

The growth of small industries in urban areas has special features of its own. There are mainly two types of small scale units -

(i) anticilliary industries, which are feeder units for the large scale sector and

(ii) general purpose units manufacturing a large variety of consumer and other goods.

The growth of both these types of units has been substantial over the last 20 years.

To understand the special characteristics of urban small industries it is desirable to know the background of the entrepreneurs who started these units. The three common type of entrepreneurs are -

a. The age old shopkeeper or a trader. The trading activities picked up quite fast particularly after independence and enterprising individuals in the field, with all their knowledge of the market and the various Governmental schemes for financial and other assistance, had all the incentive to venture into manufacturing activities.

b. The artisans who used to carry out repairing of say sewing machines, bicycles, radios etc. as they progressed in their vocation, took to manufacturing of some simple parts for the item of their specialization. With further increase of business, this led to their setting up small factories to manufacture the complete or major portion of the item.

c. Many of those who had sufficient contacts in the Government offices concerned for giving assistance of any kind, e.g. financial loans, import licences, allotment of factory sheds etc. also took the risk of setting up small scale units.

While the first two categories of entrepreneurs had some business acumen and farsightedness to succeed in their ventures, those of the last category generally had to undergo a fairly tough struggle. This is borne out by the fact that quite a few units belonging to the later category have had to close down for one reason or the other.

One factor which is commonly responsible for failure or slow growth of the small scale units is the absence of management skills. To manage men, materials and machines and to make best use of them can be quite different compared to running commercial or repair shop or having the resourcefulness to procure the necessary loan or an import licence. For the owner of a unit to think that he is capable of handling everything efficiently on his own, can be the

the greatest bottleneck in growth.

Maintenance is an integral part of the total management functions. It is basically the management's realization of the need for better machine productivity which brings out the importance of repairs and maintenance as a function. Keeping in view the above background of the entrepreneurs coupled with the fact that maintenance costs as a percentage of the total product cost are not very significant in most industries, the attention which has so far been given to this function in the Small Scale Units has been almost nil.

Most small scale units have no separate maintenance section and in most cases there may not be sufficient justification for having one either. The machines, and in some cases these are quite modern and sophisticated, are maintained either by the operators themselves or at best by a few fitters/electricians who have very little knowledge of the machine, leave alone the repair and maintenance of it. In any case, this is done only if and when the machine does stop on account of a breakdown. When the unit is pressed for capacity the considerable attention and follow up is provided by the owner/manager, but if the pressure on capacity is not there, the costly machines and equipment are normally left entirely at the mercy of the fitters. It is quite common to hear of extremely costly and sophisticated equipment imported by the small scale units by facing enormous difficulties lying idle or grossly underutilized on account of poor or no availability of maintenance facilities. In fact it is not so much the lack of maintenance facilities within the factory, as these may possibly be procured from outside sources, but the lack of adequate appreciation on the part of management

regarding the loss involved, which is the source of the problem.

3.2 TYPES OF MAINTENANCE FACILITIES REQUIRED BY SMALL SCALE UNITS

In view of the present state of maintenance and repair in small scale sector, as described so far, the facilities required are now discussed with specific reference to rural and urban areas.

3.2.1 Facilities required in Rural Areas

The repair and maintenance facilities required, are now discussed with particular reference to the mechanical means of agriculture -

a. Since the farms are scattered and this is more true of a sprawling country like India, it is not economically feasible for each farmer to have his own well equipped maintenance facilities because of the large initial investment involved. In any case, it is best for him to concentrate his energies on improving the productivity of land, rather than frittering away his resources in organizing for his own maintenance facilities, howsoever big the holding may be.

b. The tiny workshops run by the skilled tradesmen which now exist in the nearest small towns generally specialize in a specific trade e.g. a person with some knowledge of turning may have one or more lathes only. Similarly, the blacksmith and the carpenter have the skills of their respective trades only. This makes the job of repairing say a tractor or an implement even more difficult because the farmer neither has the transportation nor the time to run about from place to place collecting the necessary spares to bring them together with the other facilities required for the maintenance work.

c. For equipment like tractors and pumps as also for small metal working factories, it is most necessary to have a certain

set of spares handy if long duration breakdowns are to be avoided. This implies stocking of important spares involving tremendous cost which again is most uneconomical for the individual farmer and the small industrialist to do.

d. There are no quick communication facilities like telephone etc. existing between the remote villages and the nearest small towns, for sending information even when the service is required.

The steps necessary to solve the problems outlined earlier and to meet the special characteristics of maintenance and repair in rural areas as mentioned above, mostly requiring Governmental action, are :

a. Education of the farmers/Small workshop owners

Before any attempts are made to improve the maintenance facilities, it is necessary for the farmers and the small industrialists to appreciate their scope and need. They should be made to realize that improved productivity of the equipment employed by them would mean increased agricultural and industrial production.

Education and training of small workshop owners to make them appreciate the need for better upkeep of their maintenance facilities to improve the service they can provide to the farmers, is equally important.

Television is most useful for this type of education. Most developing countries fortunately are already aware of this powerful media of mass education.

b. Setting up maintenance workshops by Private Entrepreneurs and Farmer Cooperatives

It is very necessary for the Government to encourage setting

of composite maintenance workshops in the smaller towns most easily accessible to the villages around. This can be done both by enterprising private individuals as also by farmer and industrial cooperatives. These workshops could also stock the necessary spares, most frequently required. The specific steps which the Government can take in this direction are :

(i) to give monetary loans on easy instalment terms for purchase of maintenance machines. Suitable criteria for such loans can be evolved mainly keeping in view the technical and the organizational ability of the persons concerned as also their financial status. This can be an extremely productive avenue for employment of young engineers in the developing countries provided sufficient objectivity is used while making choice of individuals or cooperatives;

(ii) to allot plots of land at concessional rates for setting up maintenance workshop along with assured supply of power and water at nominal rates;

(iii) to give incentives to trade apprentices in the various industrial training institutes in the vicinity, for eventual employment in village workshops. This can perhaps be made a condition of admission to the institutes;

(iv) Besides the specific craft tradesmen which are trained at the industrial training institutes, it will also be desirable to have training courses for multicraft mechanics. This can obviate the necessity of employing many single craft tradesmen for small workshops.

The list of equipment for a typical village-block workshop indicating alongside the initial investment involved is enclosed. The type and number of personnel required is also mentioned.

c. Mobile Workshops run by farm equipment selling companies

Mobile workshops are extremely useful for servicing the spread out need of maintenance facilities. Such workshops consisting of say a lathe, a drilling machine, a shaper, welding set, working table and workmen's important tools and instruments etc. are mounted on a specially constructed truck. The power for running the machines is provided either by an independent diesel engine generating set or is taken from the engine of the truck. The truck can be taken to different places requiring the service. In case of places where there are no motorable roads to ply these trucks, animal driven carts are used.

It will be in the interest of tractor and farm equipment selling companies to run mobile workshops as a regular part of their after-sales service. These workshops can operate from a central place to cover an area of about 60 sq. miles or so. The necessary spares and raw materials etc. can be stored by these companies in some more central places to reduce the inventories.

The estimated cost of a mobile workshop alongwith the personnel required is indicated in the enclosure as page

As described earlier in developing countries like India, Government runs 'Small Industries Service Institutes' (SISI's) in the various states and through them the many village extension centres and the mobile workshops. These services are a useful source of providing repair and maintenance facilities for the mechanical equipment in the far flung villages which will perhaps remain economically unserviceable even if there were sufficient number of well equipped

workshops in the nearest towns. A lot, however, remains to be done to improve the working efficiency of these agencies.

The small industry in rural areas may be mostly for manufacture of agricultural implements, wooden and steel furniture, toys, processing of agricultural produce, fabrication work etc. The maintenance facilities described so far will serve the purpose of all such units fairly well.

.2.2 Facilities required in Urban Areas

Here again the most important factor as mentioned earlier is the lack of sufficient appreciation on the part of owners/managers, of the importance of maintenance function. With economies in the developing countries also getting increasingly competitive, this realization is bound to come with the passage of time. With all the Governmental protection small scale industries may continue to enjoy, their ultimate existence has got to depend upon their own strength as compared to the large scale sector, lower overheads costs being the major amongst them. This is just to underline the increasing attention the maintenance function has got to receive in course of time. The maintenance facilities which are currently made use of by the small scale units particularly in the developing countries like India are discussed below :

a. Facilities within

(i) Skills - Most factories rely on their production operatives for maintenance of machines as well. This is particularly true of industries employing basic machine tools like lathes, shapers, milling machine, grinders and the like for their production processes. This is where the production and the maintenance interests normally clash leading to poor state of maintenance of machines. The unbalanced importance given

to production by the owners/managers is the major cause of this.

On the other hand factories using special purpose machines for producing consumer goods or otherwise do have some semblance of maintenance crews but their function as defined by the generally limited concept of the management itself, again gets confined to repairing the machines, in the event of a breakdown, in the shortest possible time. The quality of maintenance jobs thus gets ignored ultimately leading to more problems and more down time on the production machines.

(ii) Maintenance Machining facilities : Wherever basic machine tools are employed for production processes, spare parts required for maintenance are made on them by interrupting the production. But industries employing special purpose machines for production, are seldom found to have maintenance machining facilities of their own on account of the large initial investment involved.

b. Use of Outside sources for maintenance machining facilities

It is a common feature in small scale units to get their maintenance machining jobs done from outside factories in the vicinity or from the nearest Small Industries Service Institute (SISI). The same is not true of maintenance personnel as the skills required by a particular unit will seldom be available from the outside sources.

The disadvantages of using the outside maintenance machining facilities are -

(i) It is generally difficult to get satisfactory precision jobs done by outside parties/SISI because the operator

making the spare part will have no knowledge of its functional importance.

(ii) It is only small scale units who would normally take up small maintenance machining jobs. Their generally low efficiency will therefore be reflected in such service jobs as well. This can lead to loss of precious production time for the unit purchasing the services.

(iii) The cost of odd jobs done by outside small units would be generally exhorbitant mainly because of non-repetitive nature of the job.

In view of the factors discussed above, the choice of having the maintenance machining facilities within the industry as compared to purchasing the outside services, will depend upon -

(i) availability of facilities in the vicinity;

(ii) the cost of down-time on the production equipment. Industries with lot of pressure on production capacity may opt for their own facilities inspite of the heavy initial investment involved;

(iii) the importance of quality and precision required in the jobs which can be got done from outside sources.

c. Basic steps necessary for improving the maintenance facilities

The first and the foremost step necessary for realization of the need for better maintenance facilities is to train the executive concerned (it may be an employee designated as foreman or the owner himself) for improving his entire concept of the maintenance function. This training which can be imparted by the Productivity Council, the SISI or any other similar bodies, must be aimed at improving appreciation of the following important factors :

(i) The importance of maintenance cost and its relation to the

total product cost;

(ii) Breakdown maintenance, its disadvantages compared with planned and/or preventive maintenance;

(iii) Training of maintenance personnel;

(iv) Installation of an accounting system for regular reporting, follow up and control of maintenance costs.

Having trained the executive concerned for better appreciation of the maintenance function and having decided on the basic maintenance policy of doing the machining jobs within or getting them done from outside parties, or to have a suitable mixture of both the alternatives, the next step lies in implementation of the programme and its continuous follow up to ensure that basic objectives of the function in terms of reduced total cost and therefore better contribution to profits, are being fulfilled.

d. Role of outside Agencies in Maintenance

(i) Private Agencies: Considering the highly capital intensive nature of the machining facilities required for most maintenance jobs it is definitely desirable to encourage development of specialized workshops (common facility centres) for the purpose. The list of equipment required for typical workshop indicating the facilities it should have, the cost involved and the personnel required is enclosed as a guide line. However, the experience gained so far in developing countries like India, on this aspect shows that it is very difficult to maintain the economic viability of such units because of the tremendous uncertainty involved regarding the load of work. On the other hand, workshops which have taken on some regular manufacturing activities, in addition to providing maintenance service to other factories, find it

easier to remain in business. A lot of course depends on how efficiently these type of units planned and are managed because with all their economic difficulties, the shortage of such facilities particularly for precision jobs continues to be felt in the vicinity of all the important centres of small scale industrial activity.

(ii) Government Agencies: Government agencies like Small Industries Service Institutes, which are mostly located near about the areas where small scale units are concentrated and Prototype Production Cum Training Centres are doing commendable work in this direction.

The main advantages these Agencies have over the privately owned workshops are -

(i) They are very well equipped with all the machines and equipment required for the maintenance jobs;

(ii) There is generally no dearth of trained and skilled personnel availability for them because the stability offered by Governmental jobs still continues to be lucrative for most people;

(iii) Such organizations have lesser difficulties for procurement of scarce and imported materials and spare parts to keep their machines and equipment in running order.

However, with all these advantages, a lot remains to be desired with regard to the efficiency of services provided by them to the small scale units. This is mainly because of lack of suitable incentives for the personnel in these agencies to give prompt and quality service.

ORGANIZATION FOR MAINTENANCE

It is common belief that maintenance of equipment suffers when it is mixed up with other responsibilities as important as production.

Too often production people take the short range view of meeting daily production schedules. They are unwilling to shut down periodically to maintain equipment. And getting the production to be as per the plan normally occupies the production supervisor so much that he is hardly left with any time for planning and implementing a proper maintenance programme.

It is for this reason that large scale companies separate the responsibility of the maintenance function from that of production. People work best when they concentrate attention on a single well defined objective in an organization. If maintenance costs are to be controlled, it is important to give to the function the status that makes it effective.

This of course does not mean that in small scale units one man must serve only one function, such as maintenance. But what is most important is that someone responsible enough (it may be the owner or the overall manager) is trained to look at maintenance problems strictly from the maintenance view point. This therefore boils down to mostly a matter of attitude and it is thus not necessary to lay down well defined rules for the organizational set up as long as there is sufficient appreciation of the function particularly in the top management.

3.4 GUIDELINES FOR OPTIMUM UTILIZATION OF MAINTENANCE FACILITIES

In addition to a well trained executive, with proper appreciation of the maintenance function and its objectives, the other factors which can help to achieve optimum utilization of the maintenance facilities are outlined below :

a. Maintenance Workload Measurement

It is commonly believed that maintenance workload, because of the non-repetitive nature of the work, is not measurable.

It is true that maintenance jobs are not so easily measurable as the repetitive production jobs, but it is a fallacy to think that they are not measurable at all. In fact, maintenance incentives, based on measured jobs, have been very extensively employed to keep maintenance labour costs under control. It is therefore important that systematic measurement is made or got made from outside agencies in order to have some guidelines for controlling the labour productivity on the maintenance jobs.

b. Maintenance Stores

In most plants the cost of maintenance materials is more than the direct maintenance labour cost. It takes good management to control it. The delegation of responsibility is complicated by problems such as -

- what materials should be used on a job;
- how much and what size material should be used;
- what materials and how much should be normally carried in stock;
- the procurement policy of materials.

The answers to these questions are normally left to the store keeper or the craftsman and the impact this has on the optimum utilization of facilities, though not very apparent can be significant.

c. Maintenance Planning

Every maintenance job can be planned. If a job is given to a craftsman unplanned, he will spend quite a lot of his time to figure out what exactly is needed, how it should be done when, where and what materials are required. All this can be avoided if the supervisor who assigns the job has sorted out these questions before hand. This will not only save maintenance labour

cost, but will also improve the utilisation of maintenance machining facilities, if available.

d. Growing need for Preventive Maintenance

The most famous preventive maintenance (PM as it is usually called) is nothing but the old saying of 'A stitch in time saves nine'. It basically implies collection and analysis of past histories of machines to work out schedules of maintenance so as to keep the unanticipated breakdowns to the minimum. Strict following of the laid down maintenance schedules is the most important single factor responsible for the success of any P.M. programme.

Preventive maintenance therefore helps to even out the peaks and troughs of workload on maintenance personnel thereby improving their average occupation besides increasing the machine productivity.

The main advantages of a Preventive Maintenance programme are:

a. Less production downtime with related savings and customer benefits, because of fewer breakdowns.

b. Less overtime pay on ordinary adjustments and repairs than for breakdown repairs.

c. Fewer large scale repairs and fewer repetitive repairs, hence less crowding of maintenance manpower and facilities.

d. Lower repair costs for simple repairs made before breakdowns, because less manpower, fewer skills and fewer parts are needed for planned shutdowns than for breakdowns.

e. Fewer product rejects less spoilage because of properly adjusted equipment.

f. Postponement of replacement because of overall better maintenance.

g. Less standby equipment thus reducing capital investment.

h. Decline of maintenance costs on labour and material.

i. Identification of areas of higher maintenance costs leading to investigation and correction of causes such as misapplication, operator abuse and obsolesence.

j. Better spare parts control which leads to minimum inventory.

These are all realistic benefits that will accrue to any industry, large or small, employing a well thought-out PM programme.

3.5 MAINTENANCE COSTS

The three major components of the maintenance cost are -

a. material cost - This will depend on correct selection, purchase and use of material or spare parts.

b. labour cost - depends on how well the craftsmen's time is utilized.

c. machine cost - in case of maintenance machining facilities within the factory the depreciation on machines, is an important cost element to be taken care of. The ignorance about this cost factor has been responsible for many problems in the small scale units. It is the cost which clearly brings out the need for a conscious replacement policy for machines.

It is important that maintenance costs, preferably under these three heads are regularly calculated based on a proper job order system so as to get a clear and regular picture about their increase or decrease.

The best indicator of maintenance efficiency is the ratiof of the total maintenance cost to the total replacement value of all the machines employed for process/production. This ratio varies anywhere between 2 and 10% for various types of industries. The best way therefore is to regularly compare this ratio with

that of similar industries to get a comparative idea of the maintenance efficiency. In case sufficient data is available for measurement of maintenance work, the productivity of maintenance labour can provide another important clue to the labour efficiency of the section.

TYPICAL VILLAGE BLOCK WORKSHOP

EQUIPMENT REQUIRED AND COST

The initial cost of land, building and the equipment required is indicated below:

	Facilities	Estimated cost in dollars.
1.	Centre lathe - one	5000
2.	Drilling machine - one	1500
3.	Welding equipment - both gas and electric	1000
4.	Bench grinder - one	400
5.	Testing equipment for fuel injection system	7000
6.	Misc. facilities like fitting bench and vice and tools etc.	500
7.	Conveyance like a motor-bike for providing the necessary mobility to the mechanics.	600
8.	Initial investment in land, building, power and water connections etc.	2600
	Total Cost	18,600

WORKING CAPITAL REQUIRED

To stock some necessary spares for tractors, pumps, motors, diesel engines, as also for normal materials required for maintenance.	2000

PERSONNEL REQUIRED

In addition to the owner/manager who should be a person with technical background and should be responsible for organizing and maintaining the facilities, purchasing, billing and collection, trouble shooting and general administration functions, the following staff would be needed. His own earnings from the venture should be about 2500 dollars/annum to make it a feasible proposition.

1.	One general purpose machinist who can operate lathe, drill, grinder and welding equipment	800 dollars/annum
2.	One general purpose mechanic or fitter with specialization in automobile maintenance. The number of such mechanics can be increased depending upon the workload.	900 dollars/annum
3.	One general purpose helper	300 dollars/annum

TYPICAL COMMON FACILITY MAINTENANCE SHOP FOR SMALL INDUSTRIES IN URBAN AREAS

EQUIPMENT REQUIRED AND COST

The initial cost of land, building and the equipment required is given below:

	Facilities	Estimated cost in dollars
1.	Land and building	7,000
2.	Centre lathes - two - one for precision jobs and the other for general purpose turning jobs.	10,000
3.	Universal Milling Machine - one	8,000
4.	Surface grinder - one	6,000
5.	Shaper - one	1,200
6.	Drilling machine - which can also work as a vertical boring machine	3,000
7.	Bench grinder	400
8.	Welding equipment - both gas and electric	1,000
9.	A Heat treatment furnace and a small forge.	2,000
10.	Misc. equipment for fitting jobs like bunches, vices, tools etc.	1,000
11.	Office equipment and furniture etc.	800
12.	Other misc. initial expenditure	600
	Total	41,000

WORKING CAPITAL REQUIRED.

For stocking the normal spares, tools and materials for maintenance jobs, electricity, gas etc.		2,000

PERSONNEL REQUIRED

In addition to the owner/manager who should be a person with technical background and who will be looking after the utilization of facilities, purchasing, billing, collection, recruitment and training of staff and general administration functions, the following technical personnel alongwith their rough cost as per Indian conditions, indicated along side will be needed.

1.	Two turner.	
2.	One machinist.	
3.	One welder/heat treatment op.	
4.	One general purpose fitter/forgeman, with some training in electrical jobs.	900x6 = 5400 dollars/annum
5.	One die fitter.	
6.	Two helpers for general purpose jobs.	600x2 = 1200 " "

The exact number of persons however should depend upon the workload and it is most important to closely control manpower utilization on maintenance jobs.

TYPICAL MOBILE WORKSHOP FOR RURAL AREAS

Plant and equipment:			Estimated cost in U.S.Dollars
i)	3/5 ton truck with special body	One	5,000
ii)	Centre Lathe	One	5,000
iii)	Drilling Machine	One	1,500
iv)	Welding equipment both gas and electric.	One	1,000
v)	Bench Grinder	One	400
vi)	Shaper	One	600
vii)	Work bench, tools etc.		1,500
viii)	Electric generating set diesel (optional)		2,000
ix)	Heat treatment furnace and forge.		2,000
			19,000

Working Capital required:

For special steels, spares and other material for maintenance, travelling, fuel oils and other charges. 2,000

Personnel required:

The mobile workshops are proposed to be operated by S.I.S.I. under the supervision of their specially trained extension officers for maintenance. The salary of such personnel is not accounted for. Other personnel required are :

1. Truck driver-cum-Generating set Operator.	One)	
2. Machinist	One)	
3. Turner.	One)	900 x 6 = 5,400
4. Welder/Heat treatment operator.	One)	dollars per year.
5. Fitter, forgeman.	One)	
6. General purpose worker	One)	

4. TRAINING OF MANAGERS, SUPERVISORS AND WORKMEN FOR REPAIR AND MAINTENANCE

Production is the result of team work between the operation and the maintenance staff and depends to a large extent on the technical competence of the men as also on their attitude to work. As production techniques are improving with the introduction of automatic and labour saving devices, the systematic maintenance of equipment is assuming every increasing importance. The equipment of today needs much more skill, attention and planned maintenance to ensure its efficient operation, than it did some years ago. Gone are the days when maintenance meant 'capital replacement' i.e. a machine or implement was allowed to run until it became unserviceable and then replaced. With growth of industrialization particularly of continuous flow type of manufacturing processes, even the breakdown maintenance i.e., repairing the machine whenever it does breakdown to make it serviceable, is becoming uneconomical because of the loss of precious production time it involves. The trend is therefore towards more and more of scheduled and preventive maintenance. Maintenance costs which were once treated as indirect and therefore less important areas of expenditure are beginning to receive increasing attention for control even in small scale units. In fact, the increasingly competitive economy is forcing the pace of this change.

To meet these exacting demands of the maintenance functions, it is very nedessary to properly select and train maintenance men, i.e. managers, supervisors and the workmen as the success of any system, howsoever well planned it may be, depends to a large extent on the quality of men responsible for it.

Training is and should be a continuous process. In small scale sector in particular, this need is hardly recognised at present. Not only the growth of operatives in some cases is taken as a danger

signal because of the fear that technicians, if they know too much, would leave for better prospects, but it is considered as an unnecessary luxury. This extremely fallacious thinking of most entrepreneurs is responsible for an extremely slow growth of the maintenance function in most of the small scale units in India and in other developing countries.

In view of the above background, it is necessary that responsibilities of the various levels of maintenance staff are analysed in detail before suitable recommendations for their training needs can be made. The subject is therefore dealt with separately each in the case of managers, supervisors and workmen.

4.1 TRAINING OF MAINTENANCE MANAGERS

Management implies planning and organization of all resources and maintenance function is no exception to it, to meet specific objectives of the business. Maintenance is therefore an integral part of management. However, depending upon the size of the small scale unit, the responsibility for this function may rest either with manager/owner incharge of the entire operation or there may be scope for having a separate manager/engineer to specifically control the maintenance activities. In either case, thorough appreciation, planning and organization of the function is necessary to achieve best results in terms of costs. The important responsibilities of a maintenance manager/engineer are -

4.1.1. Organization of maintenance facilities

These include planning and organizing of men, machines and materials required for the various repair and maintenance jobs.

(i) Men - In a developing country, the availability of skilled technicians, i.e. fitters, turners, millers, shaping and grinding operators and the like is a big problem. The need

for further specialization required for an industry to look after specific machines, further adds to this problem. Proper selection and training of maintenance men is therefore an extremely important area of the maintenance manager's responsibility.

Having selected and trained the men the job does not end there, in fact that is the beginning of it, and the most important area of his task is to ensure full utilization of these technicians. This is not at all an easy job as unlike production operations where work can be easily measured and quantified, most maintenance jobs are not easily and accurately measurable. However a lot can be learnt from the experience of Western countries where considerable research has been done in the area of measuring maintenance activities. 'Work sampling' is a technique which has been extensively used for quantifying maintenance jobs. In fact it is interesting to note that in some industries, even in India, incentives are paid based on measured maintenance work.

(ii) Machines - Whether it is necessary for a small unit to have its own machining facilities for maintenance jobs, is another area of investigation. The alternative lies in getting the jobs done from outside parties. The choice of the solution would, however, depend on many factors like maintenance workload and the type of it, facilities available in the vicinity and their cost, quality of jobs required etc. It is therefore, the responsibility of the maintenance manager to weigh the pros and cons of setting up a maintenance workshop within the operation as against making use of the outside services, to decide on the economical solution. In some cases of course the precision required may outweigh the

cheaper cost of outside jobs, in favour of setting up the maintenance facilities within. The optimum solution in some other cases may lie in a suitable mixture of the two policies.

While setting up maintenance facilities within, the responsibility of choosing the ideal and the most economical machines required for the purpose is another area of management responsibility. If such a workshop already exists the replacement or addition of machines and equipment would require management decision from time to time.

(iii) Materials - While sufficient attention is normally paid to capital investment decisions, with increasing competition and hence the pressure of costs, it is becoming equally important to control the inventories in order to economise on the working capital employment. The decision on stocking of spares and components, i.e. for fixing minimum, maximum and order levels, is an important area of maintenance management responsibility as an error in judgment particularly for the critical stock items can sometime lead to serious stoppages of production or in case of excessive inventories, to unnecessary locking up of funds which can be otherwise put to productive use.
The area of stocking spares, components and rawmaterial requirements for maintenance jobs needs regular follow up and action to keep pace with the changing conditions. It is certainly not enough to fix minimum, maximum and order levels once and forget about the same.

.1. 2. Replacement of production machines

It is not only the responsibility of the maintenance manager to ensure that production and process machinery are kept in good working condition most of the time, but it is necessary

to formulate and implement a conscious replacement policy so that the production growth is maintained at the planned pace without serious problems. This is more true of Industries in the developing countries in general and the small scale units in particular because of the foreign exchange difficulties and the lengthy procedures involved in importing equipment as also because of the unduly long delivery periods even for some indigenous items.

4.1.3. Control of maintenance costs

Maintenance costs like any other cost element can to a large extent be planned fairly accurately. Based on the past performance data of various machines reasonable estimates can be made of the future costs. The job of budgeting the maintenance expenditure and keeping the necessary follow up to ensure that the actual expenses are constantly watched and kept under control is obviously that of the maintenance manager.

4.1.4 Other managerial responsibilities - like discipline, grievance handling etc.

To meet the exacting responsibilities outlined above, it is not only desirable for the maintenance manager to be a qualified engineer, but he must have sufficient training and experience. It goes without saying that what is more necessary is a mechanical aptitude combined with the organizing, planning and executing ability rather than the qualification itself. The major components of a training programme for the maintenance manager therefore are -

(a) Sufficient background technical qualifications to ensure basic appreciation of engineering problems as theoretical background is quite necessary for solving some of them;

(b) Training on basic mechanical jobs like fitting, turning,

milling, grinding, welding etc. to have first-hand appreciation of various skills regularly required in maintenance jobs. This is necessary in addition to the exposure to these trades the engineers have during the course of their formal education. Six months to an year for this type of training is considered sufficient.

(c) On-the-job experience of running a maintenance section. This can of course be acquired gradually with the passage of time provided the aptitude is there.

(d) Contact with outside organizations and other Government and private agencies to keep uptodate on development of various methods and techniques to improve the efficiency of maintenance function.

In developing countries like India, graduate or diploma holding mechanical/electrical engineers are fairly easily available for this purpose. What is badly needed, and this is more true of small scale units, is sufficient appreciation on the part of recruiting management/owners to systematically train maintenance engineers/managers in their workshops and on the job. For this purpose, it is considered desirable if the various Government training institutes, Productivity Council, SISI's etc. have 6 months to a year's practical training course in the various trades, combined with training in industry, so as to prepare the fresh engineers for entering the industry with a more practical bias. Alternatively, this type of training can be built into the normal degree/diploma curriculam of the various engineering institutes.

The need for exposure of maintenance managers to developments in the similar functions in other industries/public sector undertakings has also not yet been fully recognised. An open minded approach

on the part of higher managements can do a lot in this direction.

4.2 TRAINING OF MAINTENANCE SUPERVISORS

By supervisor is commonly meant the person between the manager and the skilled workmen, in the organizational heirarchy, generally designated as foreman. He has to supervise the method and quality of work, instruct and guide the workers and improve their craft skill. He is responsible for the good conduct, the tone and discipline of his shop or section. He is directly accountable for the individual and the total efforts of the group under him. He is the most suitable intermediary between the management and the workmen. He is thus the most vital link between the two. His primary responsibilities include :

a. Assigns jobs to workers and allocates appropriate machines. Supervises methods of work and gives instructions and directions as and when necessary.

b. Keeps record of wastage, material and time consumption for each job and makes sure that waste is kept to the minimum necessary.

c. Ensures full and proper utilization of men, materials and machines. Assists management in setting standards and reports progress. Explains reasons for significant variations from standards.

d. Suggests method improvements, get them agreed from management and implements.

e. Trains operatives in their respective crafts and makes sure that the expected standards of quality is achieved.

f. Maintains discipline and wholeheartedly cooperates with the management for affecting any changes in working conditions or otherwise in all fairness to the employer and the employees.

g. Cooperates with the management in all activities intended to improve the working efficiencies.

The job of a foreman as described above assumes much greater

significance when looked at in the context of the role in a small scale unit where in most cases employer is the manager of all functions and foreman his technical deputy. Therefore while suggesting a suitable training programme for this kind of person, it is important to bear in mind the all round aspect of his job in a small unit, in addition to his responsibilities described above.

4.2.1 Attributes of a foreman

To fulfil the role described above the foreman must be a man of exceptional ability and must possess a keen sense of leadership. He must be fully conversant with modern maintenance methods and must be absolutely at ease while working with his own hands. These qualities are absolutely necessary for him to inspite confidence and respect from his workers.

He must be alert and full of energy. He must have high sense of accuracy and be a good judge of quality.

He must of course have the requisite qualifications and experience to understand the plant and equipment, the materials handled and the processes worked in his factory.

He must be methodical in his routine and be accurate in his analysis of men and machines under him. He must possess the ability to guide and train his men in the best possible manner.

He must be conscious of the cost factor and try to keep himself uptodate with major developments even in sections other than his own.

4.2.2 Training Requirements

To perform the jobs described above and to have the above mentioned attributes is not easy to comeby. To a small unit there are to avenues from which this kind of person can be obtained.

a. By fresh recruitment of qualified (diploma holder) mechanical

engineers with or without some maintenance experience. In the latter case the process of breaking him into the job of a maintenance supervisor will not be an easy one. In the absence of a professional maintenance manager (this role may be with the employer himself in a small factory) it is better to adopt the former course;

b. To promote one of the bright technicians - A lot of care needs to be exercised while making this type of choice because it is a common mistake to assume that a good technician must make a good supervisor as well. The right emphasis on supervisory qualities at the time of selection is crucial.

Having thus selected a man, it is extremely vital to allow him sufficient time to find his bearings as a supervisor. One of the common mistakes small scale unit employers often make is in expecting spectacular results from such recruits in a very short time. This is neither practical nor possible unless the person is a genius. This problem evidently does not apply to the person promoted from within although he is likely to have many other limitations because of his too much familiarity with the surroundings as also because of lack of suitable background qualifications which is quite often the case. Learning by committing some mistakes is extremely true of maintenance jobs and certain amount of freedom of action is therefore essential for efficient performance of duties. It is necessary that the maintenance supervisor is constantly exposed to similar personnel in other factories as also certain courses conducted on 'supervisory development' by various bodies like National Productivity Council etc.,

to keep him informed of the latest developments in his field. Besides boosting up his morale this is bound to improve his on-the-job performance. Certain Educational Institutes in India are already running 2/3 years part-time courses on 'Supervisory Development'. These are extremely useful for the ambitious technicians with potential for growth. More training courses of this type need to be organized preferably near the important industrial work centres so as to provide convenient facilities for further education and training. It is undoubtedly necessary to run such courses in collaboration with the industry so as to give them a practical bias and this is presently the case in a developing country.

4.3 TRAINING OF MAINTENANCE WORKMEN

Operatives are thinking human beings who have pride, dignity and well developed ego. They respond in accordance with the way they are treated. The concept that man is merely a source of supply of energy to be used at management's discretion to get the job done, is no more valid today. Besides research in the West has proved that if a person is properly prepared for his responsibilities the results are measurable in terms of reduced turnover and increased output.

Individuals usually produce more if they know -

- what they are supposed to do;
- what authority they have;
- what their relationships with other people are;
- what constitutes a job well done in terms of specific results;
- what they are doing exceptionally well;
- where they are falling short;

- what they can do to improve unsatisfactory results;
- that there are rewards for jobs well done and exceptionally well done.
- that what they are doing and thinking is of value;
- that the boss has a deep interest in and concern for them;
- that the boss is anxious for them to succeed and progress.

Most problems connected with people, therefore, arise mainly out of lack of communication as few people basically 'want to do a bad job'. An operator may produce poor quality because he does not fully realise how it affects the customer and/or company's business, an operator may not produce sufficiently because he may not be aware of what happens to those who do not produce well and so on. It is therefore management's job to teach workers to do exactly what is required of them. 'To do correct things' has in other words, to be ingrained in them.

All what is described so far points directly to the need for training operatives whether in production or in maintenance, but before a training programme is designed, it is necessary to be clear as to what exactly needs to be accomplished in a given situation. This involves surveying the work which is to be learned defining the training problem, analysing the work in considerable detail and identifying and developing the best methods to do the work.

Most progressive companies have what is commonly called 'Induction programme' for the technicians although what exactly is proposed to be achieved through such programmes is seldom known to all concerned. In the small scale sector particularly in the present

stage of its development of India and other similarly placed developing countries such kind of programmes are unheard of as the employers generally tend to look at such ideas as waste of time.

What is however, the heart of the training programme is called 'Skill training' which obviously means training the technician for the particular skill which he is required to use in his day-to-day work. The need for this is appreciated by the management in general whether in small or large scale. Here again, there are lot of differences in the way such a programme is administered for the new technician.

From the above background, it is clear that it is necessary to have well designed induction, attitude and skill training programmes for the workmen to ensure that they become effective soonest possible after their joining work. Not only that, it is important that such programmes are administered at regularly planned intervals to improve their skills and thus effectiveness to the organization.

Operative training is one area in which Government of India has done substantial work over the last 20 years to set up various training centres and institutes in different states to ensure that sufficiently trained tradesmen are available in good number for the industrial growth of the country. Most of these institutes recruit young boys after High School for 2/3 years practical training in different trades like fitting, turning, milling, grinding etc. The successful candidates on completion of the programme are awarded what are commonly known as ITI (Industrial Training Institutes) Certificates. In addition, there are the three Prototype and Production cum Training

Centres spread over the country to impart advanced training for a period varying between 18 months and 2 years to the students coming out of the Industrial Training Institutes. A copy of the syllabus for such training programmes, taking 'turning' as an illustrative trade, is endorsed. Inspite of all the training facilities available in the country both the Government and the private employers continue to complain regarding shortage of trained technicians. This is mainly because of not very lucrative salary structure prevalent in the country, wherein a graduate engineer with a couple of years experience can hope to earn manifold compared to a counterpart tradesman with similar ability, age and experience. This has led to an extremely high degree of popularity for the engineering graduate producing institutions and the resultant unemployment of engineers which is an indicator of unplanned growth of technical skills, with has thus taken place. The answer to all this, of course, eventually lies in reducing the prevalent disparities in income of these groups. This experience surely has a lot of lessons of offer for the developing countries.

SUMMARY OF A TYPICAL SYLLABUS FOR PRACTICAL TRAINING OF A TURNER.

A. BASIC TRAINING

This type of full-time training is provided for a period of 18 months in the various Industrial Training Institutes scattered all over the country. The syllabus for this training mainly include -

a. Fitting - Use of instruments, hacksaws, punches, files, drilling, hammering, chiselling, scraping etc.

b. Turning - To include grinding of simple turning tools, setting up work between centres use of side cutting tools, parallel and stepped turning, taper turning knurling, thread cutting, use of chucks, facing tools, simple boring etc.

c. Metal Work - Simple forging e.g. cold chisel, Hardening and tempering by colours, soldering, marking of sheet metals, cutting and bending of simple fold joints, identification of different types of steel, cast iron and non ferrous metals.

B. ADVANCED TRAINING

To build skilled turners the above type of training is not enough. In India we have Production and Prototype-cum-Training centres where further advanced training facilities are available. The syllabus for this training which is for a further period of 18 months to 2 years, includes -

a. Allied Trade training - e.g. fitting and assembly of finished machined parts, shaping milling and drilling, blacksmithy welding, brazing and foundry work.

b. Trade Training - This is the core of the training programme and 50 - 70% of the total time is spent on it. The main elements of the syllabus are -

Essentials -

(1) Working from blue-prints of engineering drawings dimensioned either in inches or in millimeters.
(2) Turning between centres. Use of half-centres. Use of mandrels.
(3) Use of independent jaw chucks, Setting up work.
(4) Setting up work using dial gauge indicators. Use of precision measuring instruments, e.g. micrometers, dial gauge comparators etc.
(5) Turning of ferrous and non-ferrous metals to include cast iron, medium carbon steel, mild steel, copper and alloy steels (where available). Use of appropriate coolants.
(6) Grinding of simple lathe tools for each of the above materials to give correct tool angles and finish.
(7) Knurling.
(8) Drilling. Boring parallel and taper holes.
(9) Grinding of twist drills.

(10) Use of boring bars and floating tools.
(11) Cutting of recesses.
(12) Screw cutting-external and internal of various types. Square threads and multiple start threads where possible.
(13) Use of form tools and form turning.
(14) Simple accentric turning.
(15) Changing of chucks and face plates.
(16) Setting up work on face plate. Balancing.
(17) Use of jigs and fixtures.
(18) Lubrication and routine maintenance of lathes.

Desirable: -

(1) Use of tungsten carbide tipped tools.
(2) Use of taper turning attachment.
(3) Use of relieving attachment.
(4) Cutting spiral grooves in bearing bushes.
(5) Setting and operation of capstan and turret lathe.

The apprentice should be able to turn to within ± .0005" (± .012 m.m.) in 1 inch dia by the end of his apprenticeship.

C. RELATED INSTRUCTIONS

The practical training described so far is coupled with theoretical training in the classroom as well, to bring about a well balanced appreciation of the trade. The syllabus for this type of related instructions includes the following subjects :

a. Workshop Calculations.

b. Engineering drawing.

c. Trade theory.

d. Social Studies.

5. PROVISION OF FINANCIAL ASSISTANCE AND SPARES FOR SMALL SCALE UNITS

5.2 AREAS OF FINANCIAL ASSISTANCE REQUIRED BY SMALL SCALE UNITS

Money is the king-pin of all human activity and it is as well true in the case of entrepreneurs interested in establishment and running of small industrial units. They require money at every step, namely

a. To make a choice of a feasible industry

This may necessitate employment of Industrial consultants (unless there is any properly organised government extension service agency rendering such service free of cost or at nominal charge) to select the right type of industry and to prepare a complete project giving details of -

(i) land, factory space, location construction costs,

(ii) requirement of machine, equipments, tools requirements alongwith their specifications,

(iii) specifications and cost of raw material both indigenous and imported,

(iv) requirements of workers, skilled, unskilled, supervisors, engineers, office staff etc. etc.,

(v) cost and quantity of water, electricity, gas etc. required alongwith their installation cost.

Feasibility and project report if arranged properly may be costly, but this is a very desirable expense as it will enable the entrepreneur to start the industry with confidence.

b. Purchase of land and construction of factory buildings.

This can mean substantial cost. However, if the entrepreneur is lucky enough to get a ready-built factory in an Industrial Estate or otherwise rent out a building, he will not incur the capital cost, and will be required to pay the rent only.

c. Purchase of machinery, equipment and tools etc.

In countries where assistance is provided by governments and/or others to supply machinery on hire-purchase, no large initial capital investment will be involved as the money can be paid back in easy instalments.

d. Working capital - Money is required for purchase of raw materials, packing materials, parts components and fastners etc., salaries and wages of workers, supervisors, office establishment, telephone, postage, maintenance and repair, including oils and greases, insurance and so on. In addition, the finished products will need to be stocked depending upon how soon these are sold off after production. In the case of seasonal products like electric fans, airconditioners etc., the stock of small feeder industries may have to be as high as 6 to 8 months production. The total working capital requirement will depend upon the turnover of the enterprise and the type of items produced besides of course the efficiency with which the inventories are managed.

e. Imported knowhow

Most of the small scale industries in developing countries have to depend on imported plant, machinery tools etc. In many cases technicians from suppliers may have to be engaged at considerable cost, to instal and operate the machines satisfactorily and most important of all to train local workers to work these machines. Engagement of foreign technicians can be quite costly unless some sort of bilatral agreement of such assistance is arranged between Government of the countries concerned.

Government in some of the developing countries have already made arrangements to provide assistance to small industries at various stages namely -

(i) Loans or advances are given to small industries to purchase land and construct factory buildings. In many developing countries, custom built factories are made available to small entrepreneurs in Industrial Estates etc.

(ii) Arrangements to supply machines on hire-purchase, at low rate of interest and on attractive terms are made. Besides avoiding lumpsum investment, entrepreneurs from cumbersome procedures of import of machinery. In addition, this method is helpful in getting right quality of imported and indigenous machines.

(iii) Some Governments have made arrangements to provide working capital against pledge of raw materials. There are credit guarantee schemes where certain amount of risk is guaranteed to be borne by the Government concerned to enable banks and other financial institutions to advance credit to small industrialists.

In spite of various forms of financial assistance provided in different countries, small scale entrepreneurs have to put in certain amount of their own savings or borrowings from friends and relations as the assistance from the Government does not cover all their requirements for funds.

5.2 PROVISION OF SPARES

5.2.1 Problem of imported spares

In most of the developing countries, there is acute shortage of technicians and skilled workers. With local workers, who are not very familiar with operation of the imported machinery

there is every possibility of the plant not giving satisfactory service and there may be frequent breakdowns requiring considerable quantity of replacement parts. The procurement of such parts, specially for imported machines is often very formidable obstacle in the smooth running of industrial plants in the small scale sector. Proper arrangements for up-keep of adequate stocks of spare parts and arrangements for prompt import are required to be made so that the wheels of the small industry continue to move on smoothly.

It is not uncommon in developing countries to come across cases of expensive imported machinery lying idle for want of few spares. The plight of the small industrialists can be well imagined when having spent their fortune in starting an industry, the production gets interrupted because of non-availability of some imported spares. This naturally leads to their feeling miserable and despondent. Some industries are even forced to close down for such reasons while others have to borrow heavily to manage to run somehow until the requisite machines are rectified. A few instances of this type which have come to the notice of the author are quoted here to highlight the seriousness of the problem of non-availability of spare parts at proper time to small industries.

a. An industrialist in India imported two stich button manufacturing machines. The machines were installed by the suppliers' technician and after satisfactory operation for some time, the cams of the machines got spoiled resulting in their poor performance. No spare cams were unfortunately available. The machines could not be worked and the factory had to shift to some other business to subsist, since it took well nigh a year to import the defective parts. Similarly a unit

manufacturing crown corks had to suffer considerable loss for want of a small part which became defective.

b. Another unit manufacturing bicycle mudguards imported an automatic mudguard rolling machine. This machine as received could not work satisfactorily since an important part had been damaged during transit and there were no spares accompanies with the machine. The Insurance Company could only compensate for the price of the part

5.2.2. Some suggestions for improving the situation

Unfortunately, no thought seems to have been given in developing countries for provision in kind or cash for supply of spare parts to small industrialists. The entrepreneurs themselves being short of finances are not in a position to tie down their capital to stock certain important and particularly imported spare parts. Besides with their limited background experience it is not easy to decide on the optimum inventory of spares required for proper maintenance of the various machines.

The Governments, through their agencies and departments responsible for development of small industries can surely provide help in this respect. Some suggestions in this connection are discussed below:

a. In countries where there are governmental arrangements for supply of machines to small industrialists, the concerned agency can, in consultation with the supplier and the manufacturer, maintain in stock a specific number and type of spares (both imported and indigenous) required for machines supplied on hire-purchase. The purchaser of the machinery may be notified the number of such spares availabp with the agency. In addition, the individual

entrepreneurs may be advised to keep a certain minimum stock themselves which can be replenished from the agency as and when needed.

It is also important to ensure with the machine suppliers, and this can best be done by the hire-purchase arranging agency, that certain quantity of vital spares are kept in stock with them in the event of stoppage of manufacture of a particular model of machinery because of changeover to an improved version. This is specifically mentioned because there have been instances of small industries in developing countries facing serious problems on account of the machinery suppliers, without keeping any stock of important spares, having changed-over to the manufacture of different models.

b. With the development of industries in the developing countries there is need to be as self-contained as possible specially from point of view of spare parts and toolings. Indigenous tool room facilities can be of considerable help to tide over the difficulties of procurement of spare parts as well as to facilitate maintenance of machines and equipment. In many developing countries, tool rooms have proved very handy for designing and manufacturing spare parts and tools in order to make the imported and other machinery run smoothly, as the imported machines which are designed to work with certain specified materials may not operate satisfactorily in the developing countries because of non-availability of materials of the same specifications. Well equipped tool rooms can play an important role to design machine components so as to make

them workable with the local raw materials.

c. In case of machines which have not been supplied on hire-purchase, it may be desirable for SISIs to keep some spares which may be of common use to a large number of industrial units as per example in order to keep the electric heat treatment and other such furnaces etc. working, it would be desirable for extension service agency to keep some stocks of heating elements. Similarly, for automatic machines, there is need to keep stock of special quality of alloy steels required to manufacture various designs of cams for different purposes.

The extension service agencies should also have provision to test physical and chemical properties of materials used for manufacture of spare parts, and also for testing of finished parts.

In brief, it may be stated that the availability of spare parts, as and when required, for maintenance and repair purposes, is very crucial for maintaining uninterrupted production to ensure sustained growth of small scale industries. It is no use having elaborate arrangements for maintenance including ear-marking of separate staff for maintenance, unless suitable arrangements are made for the availability of replacement parts as and when needed. This is all the more necessary in developing countries where most of the industries run with imported plant and machinery and there is strict control on imports because of tight foreign exchange position. It is known to have taken several months, may be a year or so, to get through the hurdle of import control even for procurement of important items from abroad.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 CONCLUSIONS

6.1.1 From all accounts it appears that there is hardly any awareness amongst even the progressive small industrialists about planned and preventive maintenance. They only take care of 'breakdowns' and carry out repairs when forced to do so and that too with hardly any organized facilities of their own.

6.1.2 Most of the small industrialists work single shift. In the event of a sudden breakdown the plant is repaired during the balance of the day to be ready for the next day. The production loss is thus made up, but no attention is normally paid to the resultant increase in the maintenance cost.

6.1.3 Most of the small industrialists opine that the loss in production due to sudden breakdowns once in a way does not justify the additional expenditure for organising improved maintenance facilities.

6.1.4 The significance of preventive maintenance is not realized at all as the stoppage of machines for such purposes is considered not only unnecessary but undesirable because it is believed that money making potential is being cut while the machines are stopped for planned maintenance.

6.1.5 Because of poor knowledge of the effect of depreciation of machines in maintenance costs, it is not realized that longer life of well maintained machines will reduce cost of productio n besides improving productivity. In view of the acute shortage of foreign exchange and difficulty of plant replacement in most ofthe developing countries, this attitude is most unhealthy for growth of small scale units.

In view of the above, it is necessary for the Governments concerned in the developing countries, to take active steps to change such an unhealthy approach so as to create suitable atmosphere and attitude amongst the small scale industrialists, through agencies entrusted with the task of development of small scale industries. The small entrepreneurs should be trained to improve their concept of maintenance which should eventually lead to betterment of the facilities requirement for proper maintenance.

6.2 RECOMMENDATIONS

In view of all what has been discussed so far, the recommendations with specific reference to each problem area are given below :

6.2.1 Training of Personnel

In most small scale industries, one supervisor is responsible for many functions, e.g. maintenance, quality control, development etc. In some cases even one of the partners in small industrial concerns looks after all these functions, with the help of one or two skilled workers. It may therefore not be easy for such enterprises to spare their personnel for long periods of training in maintenance and repairs. The extension service agencies like SISIs and Productivity Councils should arrange for on-the-spot training in such cases. The training should include a short period of exercise in other factories having well organised maintenance functions.

Specialised training will also be required for field staff of SISIs since, no such experts are available in such extension service agencies in developing countries. It does not seem to be necessary to arrange for training institutes exclusively meant for maintenance and repair problems of small scale industries. Such training may be sandwitched in the syllabus for general training imparted by the extension service agencies to small scale industries as at present. Institutes like Small Industry Extension Training Institute, Hyderabad (India), Delft Institute (Netherland) may have additional specialised courses on Preventive Maintenance and Repair. Besides a special subject on 'repair and maintenance' with particular emphasis on practical training could be included in the curriculum of degree courses for the Chemical Engineering.

Productivity Councils in developing countries can play avery important role in training the representatives of Small Industry extension officers of SISI and students of Engineering Colleges, in maintenance and repair.

6.2.2 Stocking of Spares

In developing countries, where there are strict restrictions on imports, because of shortage of foreign exchange, cumbersome and time consuming procedures have

to be followed for imports. Small industrialists with limited personnel, and with their units located far away from the Government Headquarters find it extremely difficult and costly to get imported replacement parts. These practical problems are the cause of under utilization of imported machines in many industries. Some times as an alternative make shift arrangements are made without considerations of accuracy of products and efficiency of machines. Some measures to overcome these problems are suggested below :

(i) In countries, where Governmental and other agencies supply machinary to Small industry on Hire Purchase, such agency/agencies should keep sufficient stocks of spares of machines supplied, so that these are available to purchasers of their machinery as and when required. In addition certain quantity of spares should also be given to entrepreneurs at the time of supply of machines on Hire purchase, and charged for alongwith the instalments of machinery with a reduced interest rate of 50% of the normal rate charged for machines.

(ii) Special funds at concessional rates of interest should be made available for purchase of spares by entrepreneurs.

(iii) Import licences for spares to small industrialists should be given based on the recommendation of maintenance experts of SISIs and other such agencies.

(iv) Common facility workshops and commercial private Tool Rooms be used to design and produce some common and simple type of spares.

6.2.3 Repair and maintenance workshops

Since for most small scale industris, it may not be a sound financial and utilisation proposition to set up individual workshops for maintenance and repair, it would be desirable to set up common facility workshops. Some of such workshops may be stationary, and other be mobile ones to serve remotely situated small units. Some of the workshops may equip well enough so as to enable their utilisation for manufacture of spares as well.

6.2.4 Training in Management Skills

Proper training of small entrepreneurs/managers in the latest production, maintenance, marketing and other techniques is extremely necessary for efficient functioning of small units.

The most important single reason for many unsuccessful small units is lack of knowledge of modern and professional management methods and attitudes. SISIs, Productivity Councils, Management Training Institutes can do a lot to help the small scale industries, in this respect.

6.2.5 Lack of Finances

Neither small nor large scale Industry can successfully operate without proper finances. Since small man has meagre resources, his need for outside help is obviously more. Financial assistance is required by small industry at all stages. It may be useful for the developing countries to follow the example of Indian Government in this respect.

In a nut shell, it is very essential for the Small Industries to -

a. realize the multitude benefits of improved maintenance efficiency in terms of better plant productivity leading to saving of foreign exchange and capital for reinvestment;

b. provide them with all the encouragement and help in terms of training of personnel, provision of common facility workshops, tool rooms, financial assistance and the important spares.